Chemistry I: Laboratory Exercise: Graphing Atomic Characteristics

When a person looks at a table of data, there seems to be a ton of numbers that are meaningless. They are just a bunch of numbers. Some times the best way to see if there is a meaningful rhyme or reason to a mass of numbers is to draw a picture of them. This can be done with a graph. There are several types of graphs. There are bar graphs, pie graphs, donut graphs and last but not least line graphs.

The data listed below is some information about two characteristics of some of the elements on the Periodic Table. What we need to do is make a picture (graph) of this information to see if we can find a pattern that might be hidden in all of the numbers.

The two characteristics we will look at are atomic radius and first ionization energy.

1. Atomic radius is basically the size of the atom from the center of the nucleus to the outer most edges of the electron cloud. This information has to be calculated from bonded atoms because they are just too fast and small to measure with a ruler. Before I forget, the atomic radii are measured in units called Angstroms

2. Ionization energy is the energy needed to remove an electron from the outer most energy shell of a neutral atom. The ionization energies are measured in kilocalories per mole.

Now you must construct two graphs.

1. The first graph will show atomic number and atomic radius.

2. The second graph will show atomic number and ionization energy.

Both graphs will be line graphs with the atomic number along the X-axis and the other variables along the Y-axis. Axis must be labeled with title and units.

Now place the symbol of the element next to the data point on the graph.

Once you have constructed and properly labeled the graphs, ***answer the following questions on the standard laboratory report sheets and attach your graphs***

Anyhow, on to the data.

Atomic number	Element symbol	Atomic radius	Ionization energy
1	H	0.32	314
2	He	0.31	566
3	Li	1.23	124
4	Be	0.89	215
5	B	0.82	191
6	C	0.77	260
7	N	0.75	335
8	O	0.73	312
9	F	0.72	402
10	Ne	0.71	498
11	Na	1.54	119
12	Mg	1.36	176
13	Al	1.18	130
14	Si	1.11	188
15	P	1.06	254
16	S	1.02	239
17	Cl	0.99	300
18	Ar	0.98	363
19	K	2.03	100
20	Ca	1.74	141
21	Sc	1.44	151
22	Ti	1.32	158
23	V	1.22	155
24	Cr	1.18	156
25	Mn	1.17	171
26	Fe	1.17	182
27	Co	1.16	181
28	Ni	1.15	176
29	Cu	1.17	178
30	Zn	1.25	216
31	Ga	1.26	138
32	Ge	1.22	187
33	As	1.20	242
34	Se	1.17	225
35	Br	1.14	273
36	Kr	1.12	323

Atomic number	Element symbol	Atomic radius	Ionization energy
37	Rb	2.16	96
38	Sr	1.91	131
39	Y	1.62	152
40	Zr	1.45	160
41	Nb	1.34	156
42	Mo	1.30	166
43	Tc	1.27	172
44	Ru	1.25	173
45	Rh	1.25	178
46	Pd	1.28	192
47	Ag	1.34	174
48	Cd	1.45	204
49	In	1.44	133
50	Sn	1.40	169
51	Sb	1.40	199
52	Te	1.36	208
53	I	1.33	241
54	Xe	1.31	280

Questions:

Part I

1. Formulate a general statement that describes how ionization energy changes as you go down Group1.
2. Formulate a general statement that describes how ionization energy changes as you go across a Period 4.
3. Formulate a general statement that describes how atomic radius changes as you go down a Group 2.
4. Formulate a general statement that describes how atomic radius changes as you go across a Period 4.

Part II

5.
   a. Compare the ionization energies of Group 1 and Group 18, which group has the highest ionization energy?
   b. Which group's elements would be least likely to give up electrons?
   c. What is the electron configuration for the 1st two elements of each Group?
   d. Which configuration would be most stable?
   e. How does this relate to the atomic radius graph?

6.
   a. Compare the atomic radii of Group 2 and Group 17
   b. Write the abbreviated electron configuration for the 1st two elements of each Group.
   c. Which group of elements would most likely accept electrons?
   d. From which group's atoms would it be easier to remove an electron from an atom? Why?
   e. How does this relate to the ionization graph?

7.
   a. What happens to the ionization energy values for B, Al, and Ga compared to the other elements in their period?
   b. Write the abbreviated electron configuration for each of B, Al and Ga.
   c. Which orbital is beginning to fill?

8.
   a. What happens to the ionization energy values for the elements 4,12, & 20 compared to the other elements in their period?
   b. Write the abbreviated electron configuration for each of these elements.
   c. Are these elements most likely to accept or give up electrons?

9.
   a. What happens to the ionization energy values for elements 21 to 30?
   b. Write the abbreviated electron configuration for each of these elements.
   c. Which orbitals are completely filled?
   d. Which orbitals are beginning to fill?